

EXHIBIT C

EXHIBIT C

EXPERT REPORT OF DR. BRYAN PUKENAS

I am an Associate Professor of Radiology and Neurosurgery at the University of Pennsylvania. I am a board-certified radiologist with a certificate of added qualification in Diagnostic Neuroradiology. In addition, I hold a CAST accreditation in CNS Endovascular Surgery. I am also Co-Director of the Neurointerventional Endovascular Fellowship at the University of Pennsylvania. My daily clinical practice consists of performing minimally invasive procedures of the brain and spine, as well as image interpretation, including but not limited to brain and spine Magnetic Resonance Imaging (MRI) examinations. I also teach residents and fellows in both didactic and one-on-one sessions. I have lectured and published academic works on a wide range of subjects about radiology and the practice of radiology both in the United States and internationally. My training and experience offer a unique insight as both a diagnostic radiologist interpreting MRI examinations and as a clinician treating patients with lumbar and cervical spine pain. As part of my work, I conduct peer reviews of other radiologists' work in both an academic and clinical setting. I have provided opinions on radiological practice in numerous cases and have been engaged by both plaintiffs and defendants. Pursuant to Fed. R. Crim. P. 16(b), my CV is attached as **Exhibit A** and a list of cases in which I have testified as an expert at trial or by deposition in the past four years is attached as **Exhibit B**.

I was asked by counsel for the Defendant, Dr. William Weiner, to offer opinions on standards and practices in radiology. I was also asked to examine independently each of the radiological examinations and reports that Dr. Weiner conducted of the persons identified in the Report and Supplemental Report of Dr. Scott S. Coyne, and to assess independently Dr. Coyne's evaluations of Dr. Weiner's reports (including his methodology). Finally, I was asked to offer my opinion as to whether Dr. Weiner's work in these cases was consistent with the standard of care for a radiologist.

Key Findings

As requested, I reviewed the original MRIs and Dr. Weiner's interpretive reports for the patients included in Dr. Coyne's review,¹ as well as Dr. Coyne's Report and Supplemental Report. Unlike Dr. Coyne, I also considered the clinical information available to Dr. Weiner at the time he conducted the initial reads for these patients.

I found Dr. Weiner's reports in these cases to be within the standard of care for radiologists. Further, in my review of Dr. Weiner's reports, I did not see evidence of a pattern of overreporting or exaggerating findings.²

¹ I was unable to obtain readable images for the following patients reviewed in Dr. Coyne's Report: D.D.; S.J.; Z.J.; M.K. For these patients I reviewed Dr. Coyne's reported findings. The absence of these images does not change the substance of my opinions in this case.

² As I explain further below, academic studies show that radiologists often disagree regarding particular findings when reading MRIs (and that radiologists often disagree with themselves when reading the same scan at different times). Here, although I disagreed with some of Dr. Weiner's findings, our level of disagreement was consistent with that which is reported in the literature and in line with my own experience as a practitioner. Further, to the extent that I

Different radiologists often interpret the same scan in different ways. A particular image may have multiple different characteristics that can be interpreted as “findings” of greater or lesser medical significance. As a matter of general practice, radiologists should report both major and minor findings in their reports in order to provide treating physicians with as much information as possible. That said, there are still variations in terms of how sensitive and specific a radiologist will be when detecting and describing findings that should be included in a report. That variation is evident in comparing Dr. Coyne’s reads to Dr. Weiner’s. My overall assessment of their work is that they have differing sensitivity to reporting certain findings in addition to different styles of reporting those findings.

In my opinion, Dr. Weiner’s practice of describing findings is consistent with the standard of care. In addition, the records provided to me reflect that he had access to clinical data when reviewing the scans. As discussed below, studies show that when radiologists have clinical data available to them when interpreting imaging, their overall rate of sensitivity to findings increases. Based on my review of the data, Dr. Weiner’s reads are consistent with ordinary radiological practice, even though I do not agree with all of his findings.

Dr. Weiner’s use of clinical data appears to have resulted in more appropriate diagnoses in certain instances. For example, in one case of a 16-year-old girl reporting lower back pain, N.B., Dr. Weiner’s use of clinical data likely led him to find and report an issue that both Dr. Coyne and another radiologist in Dr. Weiner’s office missed. In my opinion, this was an excellent read. It should be noted, however, that even though Dr. Weiner made an impressive finding in this instance, he actually also *underreported* the findings present in the scan. My review of the scan also detected an asymmetry in the psoas muscles surrounding the spine. In the scan, the left psoas muscle is oval-like in appearance whereas the right psoas muscle has a more rounded appearance. The rounded configuration of the psoas muscle can occur when the muscle is contracted, or flexed, and can occur when there is irritation and/or spasm from an injury. The additional finding of the right psoas muscle spasm supports the findings identified by Dr. Weiner.

In contrast to Dr. Weiner’s use of clinical data, Dr. Coyne stated in his report that he did not review or consider clinical information on the patients whose images were presented to him for his review. Clinical information on a patient’s condition is an important part of interpreting diagnostic images in radiology. It is my experience, supported by the literature in the field of radiology, that consideration of patient clinical data prior to interpreting an image leads to better

disagreed with Dr. Weiner, it was because, in nearly equal numbers, Dr. Weiner: (i) made findings that I would not have reported; or (ii) failed to make findings that I would have reported (for example, Dr. Weiner consistently failed to report findings suggesting degeneration relating to the facet joint—a set of conditions that could cause pain, particularly if aggravated by trauma). Similarly, I disagreed with Dr. Coyne’s findings both because he made findings that I would not have reported and because he failed to make findings that I would have. I should note that, in some instances, Drs. Weiner and Coyne both failed to identify findings that I would have made, such as in the case of patient E.H., who has a transitional lumbosacral vertebral segment on the left, a finding that can cause significant pain (Bertolotti syndrome), particularly after trauma. The following link describes this scenario: <https://www.summitbrainandspine.com/emy-story>. Finally, I noted that Dr. Coyne’s findings were inconsistent across the cases that he read more than once.

interpretations which, in turn, leads to more accurate diagnoses for patients. It is more likely that a physician will miss or underreport key findings when the patient's clinical history is not provided. Dr. Coyne's failure to report findings in certain cases might have prevented treatment for conditions that can cause significant pain to patients. In the case of the 16-year-old patient, N.B., with a herniated disc, Dr. Coyne appears to have relied on his general assessment that "a herniated disc is an extremely rare finding in a 16-year-old patient." That is true, but herniated discs do occur in this patient population, and this patient does appear to have one. Dr. Coyne would have been more likely to catch that had he considered the patient's clinical history.³

Dr. Coyne and Dr. Weiner have different reporting styles, including as it relates to causation or etiology. Dr. Coyne notes that certain findings were caused by pre-existing conditions or age-related degeneration (as opposed to trauma from an accident).⁴ In my practice, I typically report only the anatomical findings and avoid commenting on the etiology of findings that appear in a diagnostic scan. Likewise, as a treating physician, I prefer reports that include only anatomical findings and omit opinions regarding causation. Without understanding the clinical history and circumstances, it would be difficult for a radiologist to evaluate whether an imaging finding (traumatic, degenerative, or otherwise) is the etiology of a patient's pain. As discussed above, a pre-existing injury might be exacerbated by a traumatic event. By contrast, Dr. Weiner's reports do not comment on the etiology of his findings, which, as described above, is consistent with my practice.

The stylistic reporting differences between Dr. Weiner and Dr. Coyne is evident for patient "W.J." Dr. Weiner correctly found a syrinx (a type of spinal cyst) in the scan. Dr. Weiner's report states: "A posttraumatic syrinx is not excluded. Follow-up until resolution." From the notes, it appears that Dr. Weiner is not rendering a conclusion as to the cause of an injury; rather a post-traumatic syrinx is included in the differential diagnosis for this finding, but he is not categorically excluding trauma as a cause. Dr. Coyne, on the other hand, does render a conclusion as to the cause of the injury. Dr. Coyne admits that he neither has the patient's clinical data, nor does he "have the date of the accident," but still concludes that the syrinx "is most probably a chronic finding and is not acutely traumatic from a recent accident."

Dr. Coyne's description of the etiology of injury sometimes has the effect of minimizing findings that may be of clinical significance.⁵ For example, for patient T.H., I disagree with Dr. Coyne's description of the spinal cord as "normal" in signal and caliber. The patient's spinal cord is not normal in caliber. In addition, because there are Modic degenerative changes, the bone marrow, by definition, is not normal in signal. In another patient, D.N., Dr. Coyne ascribes chronicity to the findings, which, in my opinion, is impossible to determine on the basis of the image.

³ In the case of Patient S.Z., without any clinical history aside from what is provided in the radiology report, Dr. Coyne speculates that straightening of cervical lordosis "may be positional and not from spasm." Straightening of cervical lordosis may be secondary to pain, spasm, or positioning. There is no way to categorically deny any of these possibilities without the patient's clinical history.

⁴ *E.g.*, S.Z., E.H.

⁵ *E.g.*, S.Z., D.N. (51 y/o), H.S., T.H., V.R.

Furthermore, I disagree with Dr. Coyne's characterization of certain findings. For example, Dr. Coyne makes a finding of various degrees of "annular bulging," which he describes as "developmentally normal" in his findings for multiple patients.⁶ "Developmentally normal" disc bulging never occurs.

In other instances, Dr. Coyne criticizes Dr. Weiner for his use of certain terminology that has the same meaning as the term Dr. Coyne prefers. For example, for patient V.R., Dr. Coyne states that Dr. Weiner's read that the scan shows an "annular tear" is incorrect and states that there is an "annular fissure" present instead. This is semantics. A tear and a fissure describe the same condition. Annular Disc Tear. Steven Tenny; Christopher C. Gillis. Treasure Island (FL): StatPearls Publishing; 2023 Jan.⁷

In rendering both conclusory determinations about cause and in failing to consider patient clinical information, it is my opinion that Dr. Coyne's methodology is inappropriate. If used in a clinical setting, Dr. Coyne's approach would likely lead to reports that are more confusing and less useful for patients and treating physicians.

Standards and Practices in Radiology

A radiologist is a medical doctor who uses imaging (X-ray, CT, MRI, etc.) to "look inside the body" and diagnose disease. Radiologists are often referred to as "doctors' doctors"; by using imaging, they help other physicians detect and confirm clinical suspicions or suspected diagnosis. This is called clinical correlation – correlating imaging findings to support or refute a suspected diagnosis. One of the most powerful tools in the imaging armamentarium of radiologists is Magnetic Resonance Imaging (MRI). MRI can non-invasively look inside the body and differentiate bodily structures in a unique way, such as showing the spinal nerves, disks, and degenerative changes in a lumbar spine. Correctly interpreting MRI examinations takes years of training.

Even experienced radiologists can and do have differing opinions when it comes to interpreting MRI examinations. For example, one study found that, when interpreting cervical spine MRIs, absolute inter-rater agreement can range from 54.6% to 95%. *The Spine Journal* 16 (2016) 42-48. In layman's terms, this means that when different radiologists interpret the same MRI scan, their findings can differ up to 54.6% of the time. In another study, in which 10 different radiologists read MRIs from the same patient, researchers found high levels of variability and high rates of interpretive errors in the reported interpretive findings. *The Spine Journal* 17 (2017) 554-561. "The fact that no interpretive finding was reported unanimously by the radiologist at all centres and that one-third of all reported findings only appeared once across all 10 study examination reports indicates that there is at best significant difference in the standards employed by radiologists...and at worst significant prevalence of interpretive errors."

⁶ E.g., S.Z., S.M. (27 y/o), C.C., R.I.

⁷ Relatedly, in several instances, Dr. Weiner reported a disc "herniation" where I would have reported a disc "bulge." This difference may be the product of training. Historically, variable terms have been used to describe disk pathology, including herniation and bulging. More recently, there has been a movement towards using a standardized lexicon when describing disk pathology.

<https://spinalnewsinternational.com/alarmingly-high-number-of-interpretive-errors-and-inconsistencies-in-mri-examinations/>.

Errors, discrepancies and confounding biases are integral parts of the daily routine for radiologists and can cause various unexpected clinical consequences. It is obvious that radiological assessment of imaging examinations is a part of overall patient management that may be limited due to the diagnostic utility of the imaging technique and referral information. Therefore, radiological reports should not be expected always to be complete and correct or be regarded as the only tool to identify, confirm, or exclude the diagnosis [1, 3]. Onder, O., Yarasir, Y., Azizova, A. et al. Errors, discrepancies and underlying bias in radiology with case examples: a pictorial review. *Insights Imaging* 12, 51 (2021).

Once radiologists observe findings, they must communicate these findings in a formal report as part of the medical record. Compared with the systematic accumulation of medical facts that pertain to the practice of radiology, crafting a radiology report is a more artisanal, reflective, and creative process. The complex relationship among the patient, treatment team, and radiologist also contributes to patterns of problematic reporting. Radiologists frequently have to interpret an imaging study with limited clinical data and without the opportunity to personally assess the patient. Despite the ordering provider's expectation for the radiologist to deliver a clear answer to the clinical question, a definitive diagnosis may be out of reach because of inherent limitations of the modality, imaging findings that lack specificity, or even technical inadequacies of the study. Some radiologists may be tempted to cope with this uncertainty by simply restating findings, employing excessive qualifying language, shifting responsibility back to the ordering provider, or providing vague recommendations (9,10) *RadioGraphics* 2020; 40:1658–1670. It should be noted that terminology in radiological reporting is sometimes inconsistent and certain radiologists tend to favor certain terms over others (e.g., using the word “tear” over the word “fissure”). In today's world, where patients have almost immediate access to their medical record, radiologists are encouraged to utilize fewer technical terms in favor of more commonly used language that can be understood by patients.

Despite inherent variability in the structure and content of radiology reports, it has been shown that the addition of clinical information improves sensitivity of reporting, increasing from 38% to 84%, 67% to 73% and 38% to 52%. *J Med Radiat Sci* 68 (2021) 60–74.⁸ Put differently,

⁸ The context in which a radiologist is reviewing an image may also influence results. For example, while use of clinical data in reading images is preferable, there is literature suggesting it can lead to “framing bias,” which, for radiologists, “commonly results from the influence that the clinical history or reason for examination has on image interpretation.” See Jason N. Itri and Sohail H. Patel, *Heuristics and Cognitive Error in Medical Imaging*, *American Journal of Roentgenology* (March 12, 2018), <https://ajronline.org/doi/10.2214/AJR.17.18907>. Framing bias may also help to explain some of the differences of opinion between me and Drs. Weiner and Coyne, respectively. Dr Weiner interpreted these MRIs in a clinical context where patients complained of pain following trauma. Dr. Coyne interpreted these MRIs after the fact, without clinical data, at the request of law-enforcement authorities. I interpreted these MRIs after the fact, with the benefit of clinical data, at the request of defense counsel. These differing contexts

these statistics indicate that patient-specific clinical information allows a radiologist to make more accurate and clinically relevant diagnoses. The standard of care for reporting of findings is such that all clinically significant findings must be reported. Failure to report findings could result in denial of care to a patient in need. Usually, major findings are summarized in the “Impression” section of a report, but it is not uncommon for individual radiologists to include both major and minor findings in this same section of the report.

When a radiologist receives additional clinical information indicating that they may have missed certain findings, the normal course is to review the scan. Whether this review is performed by the original radiologist or a new radiologist is often a matter of practice preference for a specific doctor or institution. There is nothing *per se* unusual about a practitioner re-reading a scan and providing an addendum.

It is uncommon in my daily practice for radiologists to opine on the cause or severity of pain or injury. For example, I typically do not make assumptions in my reports indicating whether a particular finding was caused by a specific traumatic incident. These determinations are beyond the scope of a typical report – and for good reason. Radiologists rarely have access to the type of information – even if they are relying upon clinical data – to determine whether an injury was caused or exacerbated by a specific event or even if the imaging findings existed prior to the event precipitating the scan.

Date: December 22, 2023

A handwritten signature in black ink, appearing to read 'BP', is written over a horizontal line.

Bryan Pukenas, M.D.

Attachments: **Exhibit A** – *Curriculum Vitae*; **Exhibit B** – List of Testimony

are important because the literature suggests that radiologists have a tendency to be influenced by how a question is asked or how a problem is presented. *Id.*

Exhibit A

UNIVERSITY OF PENNSYLVANIA - PERELMAN SCHOOL OF MEDICINE
Curriculum Vitae

Date: 01/12/2023

Bryan A. Pukenas, MD

Address: Hospital of the University of Pennsylvania
3400 Spruce Street, 219 Dulles
Philadelphia, PA 19104 USA

If you are not a U.S. citizen or holder of a permanent visa, please indicate the type of visa you have:
none (U.S. citizen)

Education:

1999	BA	West Virginia University (Biology)
2003	MD	West Virginia University School of Medicine (Medicine)

Postgraduate Training and Fellowship Appointments:

2003-2004	Resident in Internal Medicine, Thomas Jefferson University Hospital
2004-2008	Resident in Diagnostic Radiology, Hospital of the University of Pennsylvania
2008-2009	Fellow in Diagnostic Neuroradiology, Hospital of the University of Pennsylvania
2009-2010	Fellow in Interventional Neuroradiology, Hospital of the University of Pennsylvania
2010	Visiting Fellow in Interventional Neuroradiology, Johns Hopkins University

Military Service:

[none]

Faculty Appointments:

2009-2010	Instructor A, Hospital of the University of Pennsylvania, School of Medicine, Department of Radiology
2011-2021	Assistant Professor of Neurosurgery, University of Pennsylvania School of Medicine (Secondary)
2011-2021	Assistant Professor of Radiology at the Hospital of the University of Pennsylvania, University of Pennsylvania School of Medicine
2021-present	Associate Professor of Radiology at the Hospital of the University of Pennsylvania, University of Pennsylvania School of Medicine
2021-present	Associate Professor of Neurosurgery, University of Pennsylvania School of Medicine (Secondary)

Hospital and/or Administrative Appointments:

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2009-present	Attending, Hospital of the University Pennsylvania
2009-present	Active, Penn Presbyterian Medical Center
2010-present	Active, Pennsylvania Hospital
2012-present	Associate, Children's Hospital of Philadelphia
2020-present	Attending, Virtua Health
2022-present	Fellowship Co-Director, Endovascular Neurosurgery Program, University of Pennsylvania

Other Appointments:

[none]

Specialty Certification:

2008	American Board of Radiology
2014	American Board of Radiology, Certificate of Added Qualification, Neuroradiology
2019	The Society of Neurological Surgeons Committee on Advanced Subspecialty Training, Neuro Endovascular Surgery

Licensure:

2009-Present	New Jersey State Medical Board
2010-Present	Pennsylvania State Medical Board
2010-Present	Federal DEA - Pennsylvania
2011	Delaware State Medical Board
2020-Present	Federal DEA - New Jersey

Awards, Honors and Membership in Honorary Societies:

2002	Alpha Omega Alpha
2011	Philips Academic Faculty Development Program, Association of University Radiologists
2021	Neuroradiology Fellow Research/Innovation Award; Mentored Dr. Kofi-Bauku Atsina - Transforaminal approach for intra-theal drug administration

Memberships in Professional and Scientific Societies and Other Professional Activities:

International:

2012-Present	Radiological Society of North America (Educational Exhibits Committee (2019))
2012-Present	Society of Neurointerventional Surgery (Senior Member)

National:

2004-Present	Radiological Society of North America
2008-2016	American College of Radiology
2009-Present	American Society of Neuroradiology (Program Committee (2014-present), Research Committee (2013-present))

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2010-Present	American Society of Spine Radiology
2011-2013	Association of University Radiologists
2012-Present	Ivy League Big Ten Concussion Research Collaboration (Member)

Editorial Positions:

2010-present	Ad hoc peer reviewer, Neurosurgery
2012-present	Ad hoc peer reviewer, Radiographics
2013-present	Ad hoc peer reviewer, Journal of Neurology, Neurosurgery and Psychiatry
2013-present	Ad hoc peer reviewer, Journal of Neuro Interventional Surgery
2014-present	Ad hoc peer reviewer, PLOS ONE
2014-present	Ad hoc peer reviewer, Academic Radiology

Academic and Institutional Committees:

2008-2010	ER After Hours Committee, Member
2012-2013	Musculoskeletal Radiology Section Chief Committee, Member
2012-2013	Neuroradiology Section Chief Search Committee, Member
2012-Present	Neuroradiology Case Conference Planning Committee, Member
2013-2015	UPHS Radiology Workshop, Invited member
2016-Present	Radiology Quality Assurance Committee, Neuroradiology Representative
2016	Organizer/Proctor - RegenexBio Clinical Trial Summit Meeting Cadaver Lab - organized cadaver lab for CT guided suboccipital puncture training (integral portion of gene therapy program)
2017	Organizer/Proctor - Biogen SMA Clinical Trial Summit Meeting Cadaver Lab - organized cadaver lab for CT guided suboccipital puncture training (integral portion of gene therapy program)
2018-2021	Penn Radiology Faculty Wellness Committee
2019	Organizer/Proctor - Prevail Therapeutics Clinical Trial Summit Meeting Cadaver Lab - organized cadaver lab for CT guided suboccipital puncture training (integral portion of gene therapy program)
2022-Present	Member, Neuroradiology Fellowship Program Evaluation Committee

Major Academic and Clinical Teaching Responsibilities:

2010	Lecture - "Interventional Stroke Management", Department of Radiology Nursing Staff, HUP
2010-Present	Grand Rounds - HUP Department of Radiology - "An Interventionalist's Approach to Atherosclerosis" "Neurointerventional CT" "QI review" - Bi-Annual
2010-2012	Lecture - "Interventional Neuroradiology Understanding the

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	Diseases, Improving the Future", Wharton School of Business, Bi-Annual
2010-Present	Neuroradiology Fellow Didactic Lecture Series - "Interventional Spine Techniques" "Neurovascular" "Spinal Interventions" "Vascular Emergencies" "Interventional Neuroradiology" "Radiation Safety in the IR Suite" "Update in Neuroradiology" "Burnout in Radiology" "Neuroradiology" "Carotid Interventions" "Spinal anatomy, and DJD" HUP - Three times/year
2010-2016	Penn CME Course - Neuroradiology Review - Medicine Rescue Services CME event for EMS responders "After the drop off - What happens to the acute stroke patient and why" - Montgomery County Fire Academy, Conshohocken, PA
2010-2016	Penn CME Course - Neuroradiology Review - "Normal Spine Anatomy" "Spine Anatomy and Degenerative Change" "An Endovascular View of Atherosclerosis from the Neck Up" "Spinal Interventions" "Acute Stroke Intervention" Philadelphia, PA - Bi Annual
2010-Present	Multidisciplinary Case Reviews, HUP - Annual
2011-Present	Multidisciplinary Resident Didactic Lecture Series - "Basic Neuroradiology" "Imaging and Treatment of Stroke" "Neurovascular" "Acute Emergency Cerebrovascular Imaging" "Neurointerventional" "Spine Anatomy and DJD" "Neuroradiology" "Normal Spine Anatomy DJD, and Trauma" "MRI for the Non-Radiologist" HUP - Six times a year
2011-Present	Lecture - "Venous Anatomy: Normals, Variants, Pathology" "Stroke Imaging and Interventions" Neuroradiology Board Review Course HUP - Annual twice per year
2012	Lecture - "Introduction to Interventional Neuroradiology", Advanced Procedures course, University of Pennsylvania X-ray technologist school
2013	Lecture - "Interventional Neuroradiology", Advanced Radiologic Procedures Class, RT Education Program, HUP
2014-2015	Mentoring - Cheryl Liu, Penn Engineering Student Outcome: Summer research project involving novel biopsy needle design. Research for Regenxbio grant "Intra Cisterna Magna Administration Technique Investigator Training on Human Cadavers" (2016).
2014	Lecture - "Imaging of Concussion", Children's Hospital of Philadelphia Second Annual Diagnosis and Management of Concussion:Acute and Specialized Therapy Across the Spectrum, Philadelphia, PA
2015	Lecture - "Nursing care for Neurointerventional CT", Nurse In-Service, HUP Radiology
2015-Present	Workshop - Office of Life Support Education (OLSE) R.E.A.D.(Radiologic Education, Assessment & Discussion) - "Imaging of Traumatic Brain Injury" "Emergency Head CT from a Radiologist's perspective" "Emergency Head CT case conference"

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	PPMC Trauma Center, Bi-Annual
2016	Grand Rounds - HUP Department of Neurosurgery - "Evidence-based Endovascular Stroke Therapy - Finally"
2016-Present	Course Lecturer - Frontiers in Radiology - FRO521 "Introduction to Interventional Neuroradiology" "Neurointerventional CT" "Acute Stroke Interventions" "Frontiers in Interventional Neuroradiology" HUP - Annual
2017	Lecture - "Interventional Neuroradiology", 1st Annual Philadelphia IR Symposium
2018	Grand Rounds - Abramson Cancer Center - "State of the Art in Management of Spine Metastases"
2018-2019	Penn CME course - Diagnosis in the Neuraxis - "Practical Anatomy of the Spine and Spinal Cord" "Spine Infections" - Philadelphia, PA - Annual
2018	Lecture - "A Novel Minimally Invasive Intrathecal Catheterization Approach for Cisterna Magna Access via Lumbar Puncture" ULAR Training Division Laboratory Animal Surgical Seminar & Vendor Fair, HUP
2019-Present	Workshop - SIGN - Student Interest Group in Neurology - Question/Answer lunch hour session, Annual
2019-Present	Course Lecturer - Frontiers in Medical Sciences - Frontiers of Biomedical Entrepreneurship - "My experience inventing a medical device", HUP - Annual
2021-Present	How to perform a suboccipital puncture non-human primate cadaver training session; June 21, 2021.
2021	UPenn Resident Lecture "Spine Anatomy" October 1, 2021

Lectures by Invitation (Last 5 years):

May, 2018	"Interventional Management of Stroke", Lancaster General Hospital Stroke Nursing Conference, Lancaster, PA
Jun, 2018	"Radiology burn-out, how it affects the new generation of radiologists", American Society of Neuroradiology Annual Meeting, Vancouver, British Columbia, Canada
Mar, 2021	"How to perform a suboccipital puncture - didactic and cadaver lab", L'institut de chirurgie guidée par l'image de Strasbourg (Institute of Image-Guided Surgery), Strasbourg, France
Mar, 2021	"How to perform a suboccipital puncture" Saint Peter's University Hospital, New Brunswick, NJ, USA
Apr, 2021	"How to perform a suboccipital puncture - didactic and head model lab", Royal Manchester Children's Hospital, Manchester, England (virtual presentation)
Jun, 2021	"How to perform a suboccipital puncture - proctor for first in human gene therapy injection for GM1 gangliosidosis" Royal Manchester Children's Hospital, Manchester, United Kingdom
Sep, 2021	"How to perform a modern day suboccipital puncture." Tel Aviv Medical Center, Tel Aviv, Israel. (virtual presentation)

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Sep, 2021	"How to perform a suboccipital puncture - Didactic and hands on training." Great Ormond Street Children's Hospital, London, England.
Sep, 2021	"How to perform a suboccipital puncture - Didactic and hands on training." Queen Square Imaging Center, London, England.
Sep, 2021	"How to perform a suboccipital puncture" UPMC Children's Hospital of Pittsburgh, Pittsburgh, PA, USA
Nov, 2021	"How to perform a suboccipital puncture - didactic and cadaver lab", L'institut de chirurgie guidée par l'image de Strasbourg (Institute of Image-Guided Surgery), Strasbourg, France
Nov, 2021	"How to perform a suboccipital puncture - didactic and cadaver lab", L'institut de chirurgie guidée par l'image de Strasbourg (Institute of Image-Guided Surgery), Strasbourg, France (two separate lectures in November)
May, 2022	"How to perform a suboccipital puncture - didactic and cadaver lab", L'institut de chirurgie guidée par l'image de Strasbourg (Institute of Image-Guided Surgery), Strasbourg, France
Sep, 2022	"What's old is new, the suboccipital puncture for gene therapy" Society for Pediatric Interventional Radiology, 10th International Meeting; Galway, Ireland

Organizing Roles in Scientific Meetings:

Nov, 2011	Panelist, 97th Scientific Assembly and Annual Meeting, Radiological Society of North America Chicago, IL
Nov, 2012	Panelist, 98th Scientific Assembly and Annual Meeting, Radiological Society of North America Chicago, IL
Dec, 2013	Panelist, 99th Scientific Assembly and Annual Meeting, Radiological Society of North America Chicago, IL
2014	Program Committee Member, 2015 Annual Meeting, American Society of Neuroradiology Chicago, IL
Dec, 2014	Panelist, 100th Scientific Assembly and Annual Meeting, Radiological Society of North America Chicago, IL
Dec, 2015	Panelist, 101st Scientific Assembly and Annual Meeting, Radiological Society of North America Chicago, IL
Dec, 2021	Neurocrine Biosciences, Inc. PD1102, PD1104, and PD1105 Data Safety Monitoring Board External Radiology Consultant virtual meeting, December 9, 2021

Bibliography:

Research Publications, peer reviewed (print or other media):

1. Oddo Mauro, Levine Joshua M, Mackenzie Larami, Frangos Suzanne, Feihl François, Kasner Scott E, Katsnelson Michael, Pukenas Bryan, Macmurtrie Eileen, Maloney-Wilensky Eileen, Kofke W Andrew, Leroux Peter D: Brain hypoxia is associated with short-term outcome after severe traumatic brain injury independent of intracranial hypertension and low cerebral perfusion pressure. Neurosurgery 69(5): 1037-45, Nov 2011.
2. Katsnelson Michael, Mackenzie Larami, Frangos Suzanne, Oddo Mauro, Levine Joshua M, Pukenas Bryan, Faerber Jennifer, Dong Chuanhui, Kofke W Andrew, Leroux Peter D: Are initial radiographic and clinical scales associated with subsequent intracranial pressure and brain oxygen levels after severe traumatic brain injury? Neurosurgery 70(5): 1095 -105, May 2012.
3. Plastaras Chris, Appasamy Malathy, Sayeed Yusuf, McLaughlin Coleen, Charles Jeremy, Joshi Anand, Macron Donald, Pukenas Bryan: Fluoroscopy procedure and equipment changes to reduce staff radiation exposure in the interventional spine suite. Pain physician 16(6): E731-8, Nov-Dec 2013.
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Exhibit B

DR. BRYAN PUKENAS

**Depositions and Testimony
(Past Four Years)**

Elizabeth Adams v. The George Washington University, et al., Superior Court of the District of Columbia, 2020 CA 004560 M

Frederick v. Kanjo, Circuit Court of Maryland, Prince Georges County, CAL20-14482

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Melissa Justice v. Meena Poddar, M.D., et al., Circuit Court of Maryland, Calvert County, C-04-CV-20-000106

Vang v. UMMC, et al., Circuit Court of Baltimore City, 24-C-19-006364MM

Askew v. Sidhu, Circuit Court of Maryland, Prince George's County, No. CAL 19-18128

Jennifer Marquez, et al. v. Children's National Medical Center, et al., Superior court of the District of Columbia, Civil Division Case No. 2019 CA 001459 M

Patricia Simon v. Montgomery General Hospital, et al., Circuit Court of Maryland, Montgomery County, Case No 480961-V

Richard Copes v. USA (VA), United States District Court for the District of Maryland, Civil Action No. 1:20-cv-02468-JRR

Julie Cullember, et al. v. Lee Anne Connell-Templin, M.D., et al., Circuit Court of Maryland, Anne Arundel County, Case No. C-02-CV-20-001487

Linares (Estate of Maria Adela Moscoso Osorio Cruz v Shirsolkar, M.D.) (defense), Circuit Court of Maryland, Prince William County, Case No. 19-3406

Kevin McAllister vs. Delaware County Memorial Hospital, et al., Philadelphia Court of Common Pleas, Case No. 180702344

Peter Aymonin v. Stuart J. Shafer, M.D., Circuit Court of Florida, 19th Judicial Circuit, in and for Indian River County, Case No. 2020-CA-000456

Larry Nelson and Gloria Nelson v. Saint Anthony Hospital, Circuit Court Illinois, Cook County, 2021 L 011021

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Raymond Rahbar, Jr. v. Virginia Medical Transport, LLC, et al., Superior Court for the District of Columbia, 2020 CA 004211 M

Janet Suglo v. Emergency Medicine Associates, P.A., P.C., Circuit Court of Virginia, Prince William County, Case No. CL-16-679

Monica Camelo, et al. v. Melissa Longely, RPA-C, et al., Circuit Court of Maryland, Montgomery County, Case No. 442210-V